

Sonoita Creek State Natural Area Healthy Water Education Program for Grades 3 Through 6

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Dear Teachers,

The Rangers at Sonoita Creek State Natural Area welcome you to the Healthy Water Education Program! We look forward to spending the day with you and your students. In this curriculum you will find:

- Background information for each ELL formatted lesson.
- Lessons aligned with state standards for grades 3-6
- Pre and post-visit lessons to conduct in the classroom
- Reproducible pages for all lessons
- Academic vocabulary words with definitions

On this field trip your students will use scientific equipment to test water quality in different locations around Sonoita Creek and Patagonia Lake. They will test lake water temperature, pH, dissolved oxygen and turbidity and will use microscopes to observe the creatures that live in the water. Through their scientific explorations, students will form a hypothesis concerning the quality of the lake's water and predict what impact water quality has on the plants and animals that call the lake home. Students will also learn about pollution and its impact on the lake environment.

It is important that your students grasp the concepts of temperature, pH, dissolved oxygen and turbidity during the pre-visit lessons, as there will not be extensive explanation of these at the park before they begin testing water samples. The pre-lessons in the Healthy Water Teacher's Guide are designed to provide students with an understanding of these testing parameters.

We have included a snack and lunch break in the schedule. Students are expected to bring their own water, lunches and snacks. If your class does not need a snack time, we'll use this time for a bathroom break or to catch up if things get behind schedule.

Each teacher will receive a Teacher's Guide. A box will be delivered to each school approximately a month before your class is scheduled for the field trip portion of the program. This box is to help you work through the pre-lessons and labs. Please share the box amongst all classrooms participating in the program at your school. If you need more materials or refills, please contact the park.

The Healthy Water Teacher's Guide includes optional scripted direct instruction. Please use this if you would like, but we also encourage you to use your own creativity and inventiveness to tailor the lessons to your classroom.

As you review the curriculum, if you have any questions, please contact the parks at 520-287-2791.

Sincerely,

The Rangers at Sonoita Creek State Natural Area

ABOUT SONOITA CREEK STATE NATURAL AREA

Sonoita Creek State natural Area is a “ribbon of life” in the desert. The natural area is nearly 9000 acres of protected land and 8 miles of creek. The management goals are:

1. protect the water flow of Sonoita Creek
2. protect the creek and upland habitats
3. maintain a diverse and healthy population of wildlife including protected species
4. protect cultural resources
5. provide opportunities for public use

Sonoita Creek State Natural Area is a sub-unit of Patagonia Lake State Park.

Areas like Sonoita Creek are called *riparian areas*. Riparian areas are places along water as well as the plants, animals and soils that make up that area. These areas can be just a few feet in diameter where a spring is located or can encompass miles, such as a stream or wetland. Riparian areas are being lost in Arizona and elsewhere. Researchers have estimated that up to 90% of riparian areas have either been lost or changed in some way. Sonoita Creek is no exception. With the damming of Sonoita Creek, Patagonia Lake was created; therefore, Sonoita Creek falls within this 90%.

Giant cottonwood, willow, mesquite, and hackberry trees, among others, line the creek. This cottonwood/willow forest type is one of the most diverse forest types on the planet. Sonoita Creek is home to hundreds of different types of birds, butterflies, dragonflies, reptiles, amphibians, mammals, and plants. Included in this list are some rare and endangered species, including the Gila Topminnow (a small native fish).

Many pressures degrade or destroy riparian areas. Some areas have been pumped dry due to development and the need for more water. A local example of this is the Santa Cruz River which, in some stretches, has little natural water flow much of the year. Riparian areas are also affected by pollution, non-native species (plants and animals from other areas that move in and take over), cattle grazing and recreational pressures from humans. Through Sonoita Creek State Natural Area’s Healthy Water Education Program, students will learn about water quality, riparian areas and the impacts that can harm these places, and some of the aquatic life that can be found here.

The staff at Sonoita Creek along with our partner, the Friends of Sonoita Creek, feels strongly that the children of today will be the stewards of tomorrow. We hope to inspire an interest and desire in your students to protect places like Sonoita Creek through our education program while helping you, the teacher, meet your curriculum goals in the areas of science, mathematics, language and art.

PERFORMANCE OBJECTIVES

1. Students will understand basic water quality testing techniques.
2. Students will understand how each component they are testing impacts water quality.
3. Students will understand how water quality and pollution impacts the plants and animals living in the lake.
4. Students will understand the importance of riparian areas and the need for their protection.

PRE-TRIP CHECKLIST

1. Call the park to schedule your field trip. (520) 287-2791
2. Read the background information for each lesson.
3. Conduct the pre-trip lessons, which are an integral part of this program. There are several lesson options.
4. Using data and information collected at the park, do the post-visit lessons. These lessons reinforce the learning that will have occurred up to this point.

WHAT TO EXPECT WHEN YOU ARRIVE AT THE PARK

1. A \$2 per student entrance fee is charged to all school groups. Please stop at the Patagonia Lake gatehouse to check-in and pay your fee. There are no additional fees for the program.
2. Please stop at the beach restrooms as the Visitor Center restrooms can accommodate only minimal use.
3. Continue on to the Visitor Center where the Rangers and Volunteers will meet your group. The bus may then park behind the Lakeside Market.
4. If your group will be eating lunch at the Visitor Center, you may bring the lunches into the Visitor Center to be stored. If you are eating lunch before or after the field trip, please leave them on the bus and eat at one of the day use areas at the beach or the point area. Park staff will work with you to schedule lunch and a snack time. Encourage your students to bring water with them.
5. Please have your group broken up into 5 groups of equal, or nearly equal size. This will save time that can be used for the field trip activities. We request one teacher or adult for each group.
6. Consider the weather--temperatures can range from the 100's to the teens. Prepare your students accordingly. Advise students to wear hats, sunglasses, sneakers or sturdy shoes and other items based on the weather forecast and season. If in doubt, bring a jacket or raincoat. If extreme weather is forecast, please call us the day before or early the morning of your trip.
7. The teacher and chaperones (not the program facilitators) are responsible discipline.
8. Special Needs-If your group includes students with special needs (limited mobility, non-English speakers, etc) please inform park staff **before** you arrive so that we may be best prepared.
9. Medical Needs-If any of your students have a condition that requires medication (such as asthma, bee sting allergies, etc.) the student or group chaperone should carry the medication at all times.

APPROXIMATE DRIVING TIMES:

Green Valley-1.25 hours

Nogales-25 minutes

Rio Rico-40 minutes

Sierra Vista-1.5 hours

South Tucson-1.5 hours

From Rio Rico and Green Valley:

I-19 South toward Nogales to exit 12-Ruby Road

Turn left and cross over interstate and go east on Ruby Road

South (right turn) on Via Frontera for 1/10 mile

Turn left on River Road (approx. 5 miles) cross one-lane bridge

Turn left on Hwy 82, 6 miles

Turn left onto Patagonia Lake Road, 4 miles

From Sierra Vista:

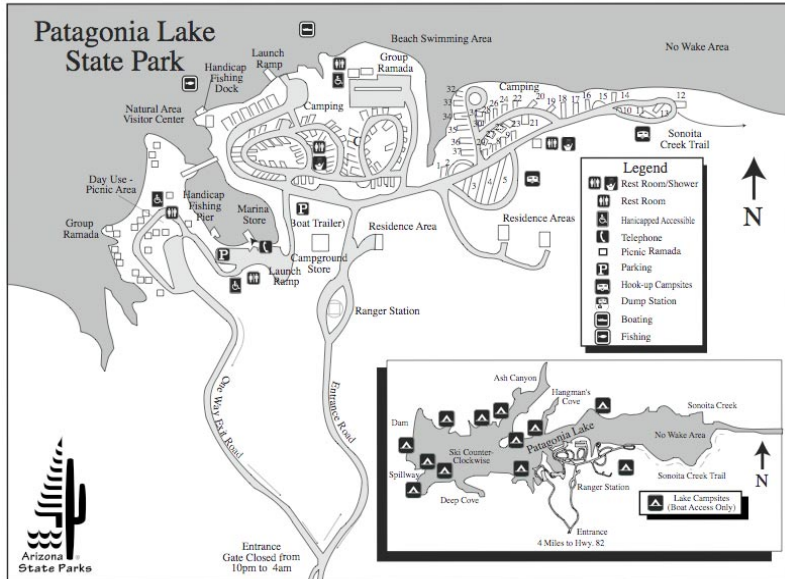
North on Hwy 90 to Hwy 82

West (left) on 82 to Patagonia

From Patagonia, 7 miles to sign on right that says Patagonia Lake State Park, turn right

4 miles to park entrance, follow signs to Visitor Center

MAP OF PATAGONIA LAKE STATE PARK



PARK RULES

1. Littering is unlawful.
2. No glass or pets are allowed on the beach.
3. Campfires must be attended and are allowed only in approved fire rings.
4. Wood gathering is not permitted.
5. All vehicles must remain on paved surfaces.
6. Damaging or removing the natural rocks, vegetation, or public property is prohibited.
7. Contact a ranger or call 911 for emergencies.

GOOD NATURALISTS AND JUNIOR RANGERS STAY SAFE AND PRESERVE HABITAT

Being safe and preserving habitat is everyone's responsibility! Students can help by:

1. Letting animals eat only food found in their habitat and not feeding them. (Ducks & squirrels included.)
2. Observing plants and wildflowers without picking them. You might be picking an animal's lunch.
3. Staying on trails and walkways. You may be walking on an animal's home.
4. Caring for trees by not climbing in them or breaking their branches.
5. Disposing of trash and fishing line in proper containers. These can be dangerous to animals and unsightly to park visitors.
6. Leaving wild berries or plants alone and for animals to eat.
7. Wearing a life-jacket while in the boat. (provided by the park)
8. Remaining seated at all times while in the boat.
9. Wearing sunscreen and drinking lots of water.

Help the Rangers keep the park clean and safe for visitors and wildlife by following the rules and instructions.

Below is an example of a typical field trip day at Sonoita Creek. The park will work with you and your class and can adjust the schedule to meet your time requirements. The “VC” is an abbreviation for the Visitor Center.

VISIT SCHEDULE

Location	Activities	~Time
Restrooms at the Beach Restroom	Bathroom Break	10 min
VC Back Deck	Welcome-Intro to Day	10 min
Microscope Lab	Look at water creatures, ID, draw	30 min
Boat (boat launch)-Water Testing I	Collect Water, Test Water	30 min
VC Back Deck/Ramadas	Lunch	30 min
VC Deck- Water Testing II	Test tap water	30 min
VC Back Deck (optional)	Snack time (optional)	10 min
Fishing Dock-Water Testing III	Test water from near shore habitat, Secchi Disk Activity	30 min
Ramada's near VC	Nature observations and discussion time	30 min
Back Deck	Wrap-up	10 min
Total		~3.5 hours

Helpful Websites

Below is a list of websites for further information.

- 1 Links to all kinds of water info including temperature, dissolved oxygen, pH, turbidity and water critters.
<http://www.ncsu.edu/sciencejunction/depot/experiments/water/waterlinks.html>
- 2 This website illustrates a program similar to Sonoita Creek's program.
<http://www.bpa.gov/corporate/KR/ed/kidsinthecreek/homepage.html>
- 3 Info on water, includes activities.
<http://www.epa.gov/waterscience/KidsStuff/>
<http://www.epa.gov/waterscience/KidsStuff/winter97/winter.pdf>
<http://ga.water.usgs.gov/edu/>
- 4 Info on macroinvertebrates (water bugs)
<http://www.ncsu.edu/sciencejunction/depot/experiments/water/macro/>
<http://www.ncsu.edu/sciencejunction/depot/experiments/water/tutorial/tutorialmacro.html>

Previsit Lesson 1: VOCABULARY

acid-substance that is located at the low end of the pH scale between 0 and 6.

algae-simple plants that usually grow in water, often using the pigment chlorophyll to make food.

aquatic-growing or living in water.

alkaline- substance that is located at the high end of the pH scale between 8 and 14.

Celsius-a scale for measuring temperature.

condense-the process by which water changes from a vapor to a liquid; opposite of evaporation.

creek-a stream of water smaller than a river.

dam-something stopping the flow of water.

degradation-to be lowered in condition; to be made worse.

detritus-loose material created by tiny broken rocks, and dead plant and animal material.

dissolve-to make a substance go into solution in a liquid.

dissolved oxygen-oxygen that is mixed in water so that animals can use it to breathe under water.

diversity-having many and varied forms of life.

dropper-a short glass or plastic tube with a rubber bulb used to measure out liquids by drops.

ecology-a type of science that studies living things and where they live.

ecosystem-a community made up of living things and how they interact with their environment.

endangered species-a plant or animal that is in danger of becoming extinct.

erode-to wear away.

evaporate-the process by which water changes from a liquid to a vapor.

exhale-to breathe out

eyepiece-the lens at the eye end of a microscope or telescope.

Fahrenheit-a scale for measuring temperature.

fertilizer-a chemical put on the ground to make plants grow.

filter-a material with small holes through which a gas or liquid is passed to separate out larger pieces.

habitat-the place where a plant or animal finds food, water, shelter and space to live.

hypothesis-a question that scientists ask, and then try to answer through more study.

ice crystal-a tiny particle of frozen water.

larva-a young wingless, often worm-like form of an insect (as a grub or caterpillar) that hatches from an egg. Plural form: Larvae.

magnification-making something appear larger by using a microscope or hand lens.

microorganism-a living thing that is so small it can only be seen through a microscope.

microscope-an instrument that uses a lens for making small things appear larger.

migration-the act of moving from one area to another with the change of seasons.

nymph- a young insect (as a dragonfly or grasshopper) that is different from the adult in the size of its body and having wings that are not fully developed.

objective lens-a lens in a microscope closest to the object being observed.

observation-gathering information by noting facts.

oxygen- an invisible gas in water used by animals for breathing.

Use your preferred format to teach students the following vocabulary words.

These words will be used in the pre and post lessons or will be used on the field trip to the park.

O₂ test kit-supplies used to find the amount of dissolved oxygen in water.

pH-a number used in expressing the amount of acidity or alkalinity in a liquid.

pH scale-Runs from 0 to 14. Seven means neutral, numbers less than 7 means more acidity, and numbers greater than 7 means more alkalinity.

physical environment-relating to natural science and what you can touch.

plankton- very small animal and plant life in water.

pollution-the act of making something impure.

power-the amount of magnification.

procedure-a series of steps followed in a regular, definite order.

population-the number of people, plants or animals living in an area.

riparian- on or near the banks of lakes, rivers, and streams.

root hair- tiny, hair-like growths on the root of a plant that help the plant absorb water and minerals.

Secchi disc-a round, black and white circle, lowered into the water to measure turbidity.

sewer pipes-pipes carrying waste water from homes and businesses to be cleaned at a waste-water treatment plant.

slide-a rectangular piece of glass used to hold objects on view under a microscope.

spring- a source of water coming up from the ground.

stream- a body of running water (as a river or brook) flowing on the land.

subdivision-a piece of land that has been divided into many smaller pieces for people to build homes on.

thermometer- a tool for measuring temperature.

turbidity- clouded by tiny particles in the water.

tweezers- a small tool that is used in grabbing or pulling something.

vapor- water in the gaseous state.

water cycle- the movement of water from precipitation (like snow or rain) from clouds to the ground where it collects (like in lakes or streams) and then evaporates back into the air.

waste-water treatment plant-a place where water is cleaned so that people can reuse it.

Vocabulary Part 2: Pictionary

ACADEMIC VOCABULARY:

There is flexibility in this activity to use all or part of the words from the vocabulary list. The list below is suggested.

algae	lake
pollution	Celsius
larva	riparian
condense	larvae
root hair	creek
magnification	Secchi disk
dam	microorganism
sewer pipes	exhale
microscope	spring
nymph	pH scale
stream dropper	thermometer
filter	dropper
tweezers	habitat
evaporate	slide
water cycle	ice crystal
plankton	
waste-water treatment plant	

LESSON PREPARATION:

Write vocabulary words on individual index cards.

Divide the class into two teams

HOW TO CONDUCT ACTIVITY:

One person from one team chooses a card. He or she has 60 seconds (or other time determined by the teacher) to illustrate the word on the board, without saying anything or making any gestures. The rest of the player's team should shout out answers until they give the right one. If they do, they get one point.

If they do not, the other team gets one guess to earn the point for themselves. A bonus point can be earned if the team who guesses the correct word can use it properly in a sentence. The team can earn another bonus point if they can spell it correctly. The turn passes to the next team.

PERFORMANCE OBJECTIVE:

Students will.....

- * Correctly spell the vocabulary words used in the game
- * Understand the meaning of the vocabulary words
- * Be able to draw the selected vocabulary words

MATERIALS:

- ❖ Whiteboard with dry erase markers
- ❖ Index cards
- ❖ Pencil
- ❖ Vocabulary list

Previsit Lesson 2: LEARNING ABOUT MICROSCOPES

PART 1: PARTS OF A MICROSCOPE

Scientists use a **microscope** to see very small objects and their details. The working part of the microscope is the **body**, a tube with a lens at each end. The top lens is called the **eyepiece**. The lens at the bottom of the tube is called the **objective lens**. The tube is moved up and down to focus on the object that rests on the **stage**. Microscope **slides** are placed on the stage to hold objects being viewed. The **arm** holds the body suspended above the stage. Light passes through a hole in the stage and then through the object. Focusing the Magiscope is accomplished by slightly twisting the body up or down. The **base** supports and stabilizes the entire microscope.

A microscope is a fragile piece of scientific equipment. If you must pick up a microscope, you should grasp the **arm** with one hand, lift the microscope and support the **base** with your other hand.

OPTIONAL DIRECT INSTRUCTION:

Teacher will...

ASK "Have you ever used a microscope before?"

"What do you think a microscope does?"

"How small an object do you think you can see?"

"Why would you want to see something that is not visible to the unaided eye?"

SAY "We are learning about the parts

of a microscope because you will be using a microscope at the park during your field trip."

Students will....

RESPOND to questions individually or discuss in small groups before responding.

Teacher will....

SHOW the Parts of a Microscope transparency on the overhead. POINT to each part of the microscope. ENCOURAGE students to repeat the names of the parts in a choral response.

DISTRIBUTE the Parts of a Microscope worksheet to the students.

Students will....

REPEAT the name of each part after the teacher pronounces the part name.

Teacher will....

WRITE the name of each part in the column marked PART.

Students will

WRITE the names of each part in the column marked PART on their worksheet.

Teacher will....

SAY "What do you think these parts do?"

ACCEPT any answers from students. WRITE in any correct responses in the column marked JOB (function).

Students will....

WRITE correct functions into the column marked JOB (function).

PERFORMANCE OBJECTIVE:

Students will.....

- * Locate parts of the microscope (Brock Magiscopes)
- * Identify parts by name
- * Know the function of the parts

MATERIALS:

- ❖ Parts of the Microscope and Microscope Identification student worksheets
- ❖ Parts of the Microscope overhead transparency
- ❖ Overhead projector
- ❖ Markers

ACADEMIC VOCABULARY:

microscope
magnification
eyepiece
objective lens
power
slide

LESSON

PREPARATION:

- * Make copies of Parts of a Microscope for students
- * Make an overhead transparency of Part of a Microscope

Teacher will.....

DISTRIBUTE Microscope Identification worksheet.

SAY “Help me find each part on the microscope drawing. Write the name of the part on your worksheet as I write it on the overhead.”

Students will....

RESPOND by saying the parts as teacher points to them on the drawing. WRITE in the part name.

GUIDED PRACTICE:

Teacher will....

ERASE the answers on the overhead transparency of the Parts of a Microscope.

ASK students to name the parts of the microscope (you may choose how they respond).

ASK students to name the function of the parts.

WRITE in the correct answers on to the overhead as students respond.

CLOSURE:

Teacher will...

ASK “Who is ready to use a microscope during the field trip?” Teacher can choose how students respond.

“Write down three facts you learned about microscopes. Tell your partner what you wrote.”

Students will....

WRITE on notebook paper three facts they learned without looking at their worksheets.

TELL another student what they learned.

PART 2: HOW TO CALCULATE MAGNIFICATION

A microscope allows you to see very small objects by using a combination of lenses to magnify them. The lenses come in different **powers**, or amounts of magnification. The power of magnification is written on the side or top of each lens, and expressed as a number and a times sign, like 10X, meaning that the item observed would appear to be 10 times larger than it actually is. When you look at an object in a microscope, it is helpful to know how much it is being magnified. To calculate the magnification, multiply the numbers found on the eyepiece and objective lens. That will represent the amount of magnification. The microscope has 2 interchangeable eyepiece lenses with powers of 5X and 10X. They have 3 objective lenses with powers of 4X, 10X and 40X.

OPTIONAL DIRECT INSTRUCTION:

Teacher will.....

SAY “Magnification means how much bigger an object looks through a microscope.”

SAY “We will observe the amount of magnification on the eyepiece and objective lens.”

POINT to the picture of the microscope using the transparency on the overhead.

ASK “Where is the eyepiece?”

WRITE 5X on the eyepiece and have students do the same on their worksheets.

PERFORMANCE OBJECTIVE:

Students will.....

- * Multiply the eyepiece and the objective lens numbers
- * Calculate the amount of magnification
- * Write the answers on the chart

ASK "Where is the objective lens?"
WRITE 4X on the objective lens and have students do the same on their worksheet.

Teacher will....

SAY "On a real microscope, such as the ones you will be using at the park, there will be a number on each lens that represents its power."

SAY "To calculate magnification, you multiply the power number found on the objective lens with the one on the eyepiece."

WRITE on the Magnification Chart one or two of the answers with help from student responses.

GUIDED PRACTICE:

Teacher will.....

INSTRUCT students to fill in the remainder of the magnification chart at the bottom of the Parts of a Microscope worksheet.

ASK "Why is knowing magnification important?"

Students will.....

COMPLETE the chart .

CLOSURE:

Teacher will...

ASK "Who has the skill to use a microscope on the field trip?"

ASK "Write down three more facts you learned about microscopes. Tell your partner what you wrote."

Students will

WRITE on notebook paper three more facts they learned without looking at their worksheets.

TELL another student what they learned.

ASSESSMENT:

Teacher will.....

ADMINISTER a quiz with the following questions.

1. If I wanted to focus the microscope I would move this part up and down. (*body*)
2. Name the lens I look through. (*eyepiece*)
3. I hold on to the base and (*arm*) to carry the microscope.
4. I place an object to look at on a (*slide*) and look at it on the (*stage*).
5. Magnification can be figured out by this math operation. (*Multiply*)

TUTORIAL & ENRICHMENT ACTIVITIES:

For a more kinesthetic approach to learning the parts of the microscope you may consider the following preparation:

Make parts of the microscope (like puzzle pieces) out of colored tag board so students can assemble the parts as they are learning them.

PARTS OF A MICROSCOPE-Teacher's Key

BACKGROUND:

A microscope is a science tool that helps you see details of tiny organisms or small objects that are placed on the stage. Each part of the microscope has a job to do to help magnify the object for closer view.

PROCEDURES: PART 1

1. Identify the parts of the microscope and write them in the column marked PART.
2. Write the purpose of each part of the microscope in the column marked JOB (Function)

	PART	JOB (function)
1.	<i>EYEPIECE</i>	<i>Top lens on the body where you place your eye.</i>
2.	<i>BODY</i>	<i>The moving part of the microscope that holds a lens on each end.</i>
3.	<i>ARM</i>	<i>Holds the body</i>
4.	<i>OBJECTIVE LENS</i>	<i>Bottom lens on the body that helps magnify the object being viewed.</i>
5.	<i>STAGE</i>	<i>A flat platform that holds the object to be viewed.</i>
6.	<i>BASE</i>	<i>Supports and stabilizes the microscope</i>

PROCEDURES: PART 2

Calculate the magnification by multiplying the eyepiece power by the objective lens power.
Write your answer in the column marked MAGNIFICATION

MAGNIFICATION CHART

Eyepiece Power	Objective Power	Magnification
5X	4X	20X
10X	10X	100X
5X	10X	50X
10X	4X	40X

PARTS OF A MICROSCOPE

A microscope is a scientific tool that helps you see details of tiny organisms or small objects that are placed on the stage. Each part of the microscope has a job to do to help magnify the object for closer view.

Instructions:

1. Identify the parts of the microscope and write them in the column marked PART.
2. Write the purpose of each part of the microscope in the column marked JOB (Function).

	PART	JOB (function)
1.		
2.		
3.		
4.		
5.		
6.		

Instructions:

Calculate the magnification by multiplying the eyepiece power by the objective lens power.

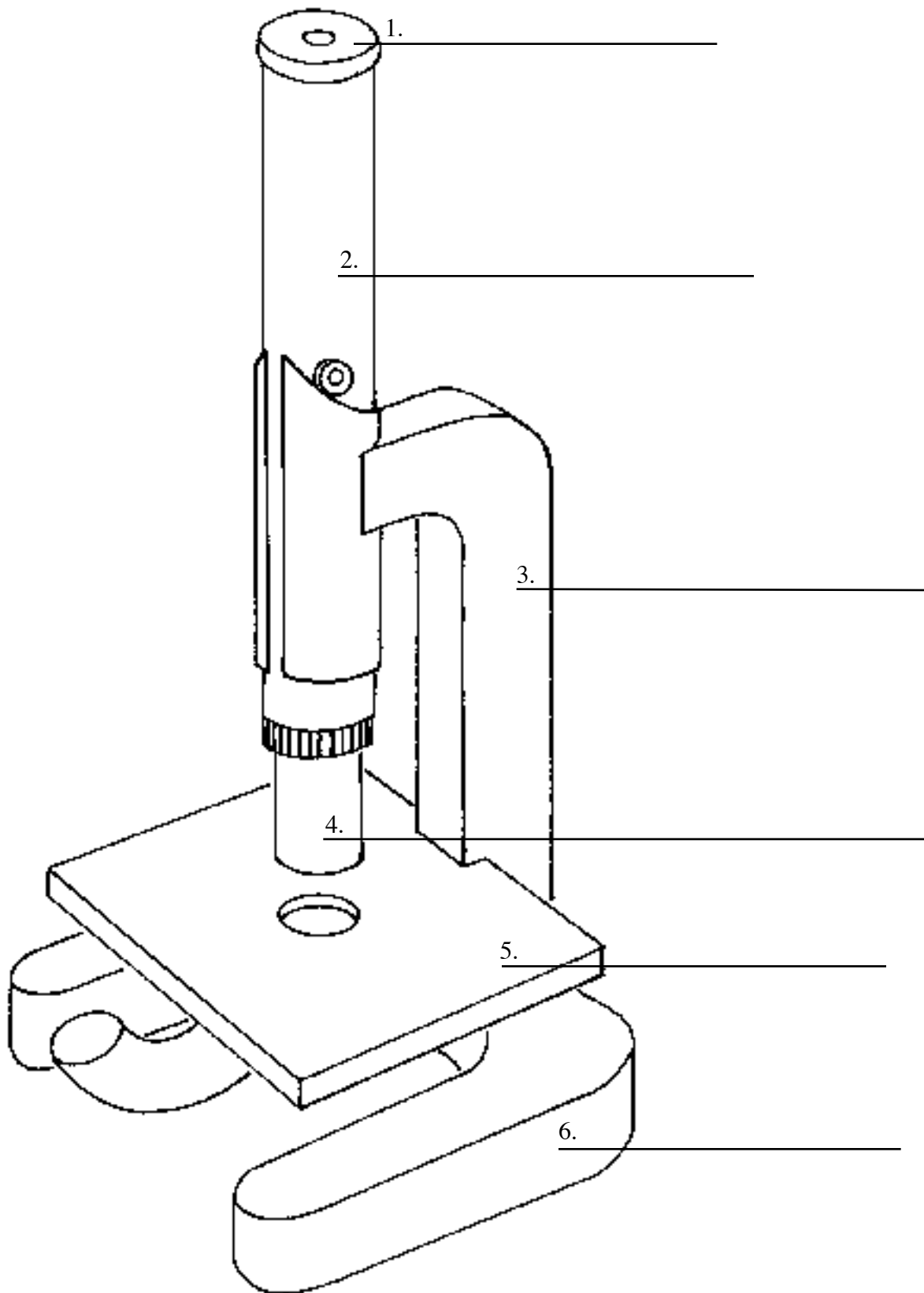
Write your answer in the column marked MAGNIFICATION

MAGNIFICATION CHART

Eyepiece Power	Objective Power	MAGNIFICATION
5X	4X	
10X	10X	
5X	10X	
10X	4X	

Parts of a Microscope

Instructions: Label each part of the microscope



Previsit Lesson 3: LEARNING ABOUT THE WATER CYCLE

LESSON PREPARATION:

Copy to an overhead transparency
Where On Earth is Water Found ?

Copy worksheets for students Where On Earth is Water Found ?

Prepare one glass of water in a clear container

PART 1: WHERE IS WATER FOUND ON EARTH?

This activity is designed to help students understand that water moves about the earth and can be found in the ocean, lakes, streams and rivers, clouds, plants, animals, groundwater, and glaciers! Water is neither gained nor lost on the earth, it simply moves from one location to another. This is called the water cycle. The sun's heat and the earth's gravity keep water in constant motion. The cycle is a never ending journey. Since 70% of the earth is covered by ocean, water can spend years in the ocean, evaporate, form clouds of water vapor (water in a gaseous state) and rain back into the ocean as a liquid. Water can also spend years locked underground in ground water located just below the surface or in ancient aquifers buried deep below the surface. Water can also be found frozen in a glacier or snow pack. Water is present on Earth in three phases of matter: solids, liquids & gasses. Water can change phases depending on environmental conditions.

OPTIONAL DIRECT INSTRUCTION:

Teacher will.....

ASK "How much water is on the earth?" Accept all answers.
SAY "It is amazing to know there is 326 million trillion gallons of water on earth!"

WRITE the number on the board - 326 followed by 18 zeros!

(326,000,000,000,000,000,000)

ASK "Where on earth is water found?"

ASK "In what form do you find water? " solids, liquids, or gasses?"
SAY "Today we will think of all the places water can be found on Earth, then we will determine whether that water is a solid, a liquid or a gas."

EXPLAIN how students will contribute answers to the question.

WRITE ideas on the overhead Where On Earth is Water Found ?

ADD any additional ideas.

Students will.....

RESPOND to the teacher question.

CONTRIBUTE ideas to the transparency.

COMPLETE the worksheet Where On Earth is Water Found ?

PART 2: WADE WATER DROP

As you read the story of Wade Water-drop pause to point out places on the water cycle poster where Wade is currently located in the story. The story is at the end of this lesson.

PERFORMANCE OBJECTIVES

Students will.....

- ✳ Identify where water can be found on Earth
- ✳ Hypothesize the form or phase of water
- ✳ Comprehend the basic structure of the water cycle
- ✳ Relate the water cycle to Earth's processes
- ✳ Listen to a story about the water cycle
- ✳ Apply the concepts of the water cycle to a creative story or project

MATERIALS:

- ❖ Transparency of Where on Earth is Water Found ?
- ❖ Overhead projector
- ❖ Transparency markers
- ❖ Water Cycle poster

ACADEMIC VOCABULARY:

water cycle
evaporate
condense
transpiration

OPTIONAL DIRECT
INSTRUCTION:

Teacher will....

SAY “Now that we have named where to find water on Earth, how do these places fit into the water cycle?”

SHOW a poster of the water cycle.

INTRODUCE the concepts of the water cycle

EXPLAIN the vocabulary words of condensation, evaporation and transpiration.

SAY “Get ready for a story about the water cycle.”

SAY “This is a story about a drop of water found in the glass of water. Wade Water Drop will have many adventures in the story and we are going to show where he went by using the poster.”

READ the story about Wade Water Drop.

Students will....

LISTEN to the story of Wade Water Drop.

Teacher will....

ASK the students to remember any other places heard in the story where water is found?

ENRICHMENT:

1. Write their own water cycle story (creative writing).
2. Invent a game about water’s wanderings.
3. Draw the water cycle.
4. Draw the places where water

can be found to illustrate the story.

5. Create a dichotomous key story (Wade drops to the earth. Does he sink into the soil OR end up in a stream?

Choosing the stream: does he go underground to join the ground water in a cave OR flow into a lake?

In the lake: does he get swallowed by a fish OR does he go to a house riding on a wet bathing suit?

The Adventures of Wade Water Drop!

Have you ever thought about the journey that the water in this glass may have taken before it got here? Where might it be going after you swallow it? Water moves from place to place in a system called the “water cycle.” It never completely disappears from the Earth, but sometimes it stays hidden for long periods of time.

Let’s think about a drop of water and its journey. Since 70% of the earth’s surface is covered with water, let’s begin the story in the ocean.

Wade Water Drop had been in the ocean with billions of other water drops for a long time. He swirled with the currents, sometimes plunging down in the depths where it was cold. Other times he would rise to the surface in a warm tropical sea. That’s where he was when the sun beat down on him, turning him into water vapor. He became invisible! He floated up, up into the atmosphere. Higher and higher he went. Below, he saw land. He was beginning to get lonely up there all by himself.

Still, he rose higher until the air around him got cold. Wade got so cold that he condensed into a visible water drop again. Surprise! Many other water drops appeared around him! They had been invisible, too, but had condensed like he had. All the water drops hung in the cold air forming a fluffy, white cloud. The wind blew the cloud over the warm land. Near the top of the cloud it was so cold that Wade became a small ice crystal. Brrr! Other ice crystals bumped into him. Soon, there were many of them clinging together, getting heavier and heavier. Wade could feel them begin to fall, spiraling toward the ground. He got warmer and melted, but so did the other ice crystals. They were falling as a raindrop, hurtling toward the ground! What a ride!

Splat! Wade’s raindrop hit a rock. Ouch! He rolled down the rock and was soon joining other water drops in a small stream. On and on they flowed. Later that day a gold miner scooped Wade up and swirled him around in a pan with some dirt. Wade sloshed out of the pan and continued on his way. The next day a cow drank Wade! That was weird! He traveled around her body until he got to her lungs. That night the cow exhaled Wade Water Drop out of her lungs as water vapor. It was a chilly night so he condensed with other drops and floated slowly to the ground.

Wade sank into the soil where he landed. Down between the dirt particles he flowed. He touched something soft; a root hair from a grass plant. The root hair soaked him up. Soon he was moving faster and faster, up the grass stalk toward the leaves. While he was resting in the blade of grass something unexpected happened. A rabbit nibbled the grass blade where Wade rested! It was very dark in the rabbit! But it wasn’t quiet. Thump, thump. Thump, thump. Wade was part of the rabbit’s blood. He swished and swirled through the rabbit’s heart thousands of times a day.

Several days later the rabbit’s heart began to beat VERY FAST. Wade could tell that something was wrong. Suddenly, it got very quiet. The heart had stopped. What was happening? A coyote had killed the rabbit and was eating it. Wade escaped and oozed down into the ground again. Where else would his journey take him?

He joined other water drops in the soil, sliding down to the bedrock, through the cracks and crevices until they emerged from the side of a hill as a spring of clear water. This spring was the source of a creek. Wade’s creek was joined by another and another. Occasionally rain washed down the sloping banks, adding to the volume. By now, Wade was in a stream, moving faster and faster. Suddenly, the stream slowed. Wade was in a lake. A large black hole loomed ahead, and Wade found himself being pulled toward the pipe opening. Swoosh! In he went! Up the pipe he rushed. He found himself in a water treatment plant. He squeezed through filters, and mingled with chemicals to kill harmful organisms. Finally, he entered another pipe where he hurried along with many other water drops.

Squirt! Out of a faucet gushed Wade! He found himself in a glass about to be swallowed! The lady swished Wade around in her mouth for a few seconds and spit him into the sink. Down the drain went Wade. Down through the sewer pipes to the wastewater treatment plant. After the journey through that, he was pumped to a river and dumped in, all sparkly and clean. Wade flowed along with all the other drops. Sometimes they moved slowly through lakes and sometimes fast over dams. Finally, Wade noticed something familiar. He was back to the ocean! What a voyage it had been!

WHERE ON EARTH IS WATER FOUND ?- Teacher's Guide

Water moves about the Earth from one place to another place. Water is in constant motion. This is called the WATER CYCLE. Water is neither gained nor lost on the earth. You might say that water gets recycled around the planet. Water changes its form if conditions are just right. The three forms are *liquid*, *solid* or *gas*. The most familiar form is liquid water found in oceans or lakes. Very cold liquid rain water freezes into snowflakes to form solid water. Very hot liquid water forms steam which rises as gaseous water.

Think of as many places or ways you might find water on Earth and record answers in the 1st column.

Tell whether that water is a solid a liquid or a gas and record your answer in the second column.

	WHERE IS WATER FOUND ON EARTH?	In what form is it found? Solid? Liquid? Gas?
1	<i>Oceans (salt water)</i>	<i>Liquid</i>
2	<i>Lakes (fresh water)</i>	<i>Liquid</i>
3	<i>Rivers (fresh water)</i>	<i>Liquid</i>
4	<i>Glaciers</i>	<i>Solid</i>
5	<i>Clouds (water vapor)</i>	<i>Gas</i>
6	<i>Groundwater</i>	<i>Liquid</i>
7	<i>Plants (holds liquid water and transpires water as a gas)</i>	<i>Liquid</i>
8	<i>Aquifers (ancient water)</i>	<i>Ancient liquid</i>
9	<i>Animals</i>	<i>Liquid</i>
10	<i>Water pipes</i>	<i>Liquid</i>
11	<i>Snowflakes</i>	<i>Solid</i>
12	<i>Rain</i>	<i>Liquid</i>
13	<i>Geysers (super heated)</i>	<i>Gas & liquid</i>
14	<i>Icebergs (super cold)</i>	<i>Solid</i>
15	<i>Humidity (water vapor)</i>	<i>Gas</i>
16	<i>Condensation</i>	<i>Liquid</i>
17	<i>Steam</i>	<i>Gas</i>
18		

WHERE ON EARTH IS WATER FOUND ?

Water moves about the Earth from one place to another place. Water is in constant motion. This is called the WATER CYCLE. Water is neither gained nor lost on the earth. You might say that water gets recycled around the planet. Water changes its form if conditions are just right. The three forms are *liquid*, *solid* or *gas*. The most familiar form is liquid water found in oceans or lakes. Very cold liquid rain water freezes into snowflakes to form solid water. Very hot liquid water forms steam which rises as gaseous water.

Think of as many places or ways you might find water on Earth and record answers in the 1st column.

Tell whether that water is a solid a liquid or a gas and record your answer in the second column.

	WHERE IS WATER FOUND?	In what form is it found? Solid? Liquid? Gas?
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		

Previsit Lesson 4: WATER TESTING: DISSOLVED OXYGEN

PART 1 LAB EXPERIMENT: What is DISSOLVED OXYGEN?

The air we breathe is about 20% oxygen. The other 80% is nitrogen, argon, carbon dioxide and other gasses. Most living animals, no matter how small, require oxygen to survive and the creatures living in the water are no exception. Oxygen that is dissolved in the water is available for them to breathe. How does oxygen get into the water? Wind, rain, waves, and currents that move the water help get oxygen into the water. Faster moving water has more dissolved oxygen (D.O.) and slow moving water has less.

Other things can change the amount of dissolved oxygen found in water; temperature, weather, salinity (amount of salt) and plants. Cold, fresh water holds more D.O. than warm or salty water. If weather conditions are hot and dry, the water temperature rises, evaporation occurs and the water cannot hold as much dissolved oxygen. In the summer, water temperatures rise as the day progresses, causing oxygen levels to decrease by late afternoon. The number of plants living in the water can also affect the amount of dissolved oxygen. On sunny days aquatic plants release oxygen into the water as a byproduct of photosynthesis.

OPTIONAL DIRECT INSTRUCTION:

Teacher will...

SHOW the students a glass of water.
SAY "Sometimes there is more in water than you can see just by looking at it."
ASK "What might be in water that we cannot see?"

Students will

RESPOND to the question in any format the teacher has for the classroom.

Teacher will.....

SAY "What kinds of things might be in a swimming pool or an ocean we cannot see? Think about how the water tastes when you accidentally drink some."

Students will.....

ANSWER the question like salt, chlorine, little animals.

Teacher will.....

SHOW the glass of water again to the class.

SAY "Today we will learn about another invisible substance in the water, oxygen."
ASK "What is oxygen?" Accept all answers.

WRITE the definition on the board.

OXYGEN IS AN INVISIBLE GAS

ASK "What is dissolved oxygen?"

WRITE the rest of the definition.

DISSOLVED OXYGEN IS AN
INVISIBLE GAS IN WATER

SAY "Dissolved oxygen is in lakes, oceans, creeks, and even this glass of water." (Show a glass of water)

ASK "Who uses this oxygen?"

WRITE the remainder of the definition.

DISSOLVED OXYGEN IS AN
INVISIBLE GAS IN WATER AND
IS USED BY AQUATIC ANIMALS
FOR BREATHING.

GUIDED PRACTICE:

PERFORMANCE OBJECTIVES

Students will.....

- * Conduct a lab experiment
- * Illustrate an academic vocabulary word

MATERIALS:

- ❖ One What is Dissolved Oxygen? worksheet per student
- ❖ Warm water
- ❖ Granulated sugar
- ❖ 2 clear cups per group
- ❖ Popsicle stick

ACADEMIC VOCABULARY:

dissolved oxygen
oxygen
aquatic
dissolve

LESSON PREPARATION:

Copy worksheets & quizzes
Prepare warm water
Assemble lab equipment for a demonstration *or* for each table group.

Organize per group:

2 clear cups
small baggie of granulated sugar
popsicle sticks
teaspoon

Teacher will.....

SAY “We will conduct an experiment with sugar to understand the vocabulary word ‘dissolved,’ then we will connect this to the idea of dissolved oxygen.”

DISTRIBUTE Lab experiment – What is Dissolved Oxygen?

ASK “What is the meaning of the vocabulary word dissolved?”

TO MAKE A SUBSTANCE GO INTO SOLUTION IN A LIQUID.

WRITE the definition of dissolved on the board.

ASK “What is the definition of dissolved oxygen?”

OXYGEN THAT IS MIXED IN WATER SO THAT AQUATIC ANIMALS CAN USE IT TO BREATHE UNDER WATER.

SAY “Are you ready to do a lab experiment to learn more about the word “dissolved?””

SET UP lab equipment.

Students will.....

COMPLETE the experiment or demonstration and answer all of the questions.

Teacher will.....

SAY “Even though you cannot see the sugar in water it is still in the water, but it has been dissolved.”

CLOSURE

Teacher will

ASK “How is this experiment with sugar like dissolved oxygen?”

Students will....

ANSWER the question by talking in groups and writing down their response.

LAB EXPERIMENT – *What is Dissolved Oxygen?*

Dissolved oxygen is an invisible gas that is in water like a lake, ocean, creek and even a glass of water. Dissolved oxygen is used by aquatic animals for breathing. A high amount of dissolved oxygen means healthier water, healthy animals and healthy environment.

QUESTION: What is dissolved oxygen?

MATERIALS per student group

1 container of warm water
2 clear cups
1 teaspoon of granulated sugar
Popsicle stick for stirring

PROCEDURE

Step 1. Pour 8 ounces of warm water into a clear cup

Describe how the water looks. _____

Step 2. Add 1 teaspoon of sugar to the other cup.

Describe how the sugar looks. _____

Step 3. Slowly pour the sugar into the warm water. Watch the water as you pour the sugar into it. What did the water look like when you were pouring the sugar into it? _____

Step 4. Begin stirring the water and keep stirring until all the sugar is dissolved. What does the water look like now? _____

Is the sugar still in the water? _____

How can you tell? _____

What do you think happened to the sugar? _____

How is this experiment with dissolved sugar in water like dissolved oxygen in water? _____

PART 2: BUILDING ACADEMIC VOCABULARY & QUIZ:

Build academic vocabulary further by allowing students to illustrate these words:

Oxygen, dissolved, & dissolved oxygen

GUIDED PRACTICE:

Teacher will....

SAY "On our field trip to Patagonia Lake you will experiment with lake and tap water to find out if there is dissolved oxygen. You will find out whether the water has enough dissolved oxygen to maintain a healthy environment for animals."

Teacher will....

CONDUCT an activity (teachers' choice) as a vocabulary builder for the words dissolved oxygen, oxygen, dissolved.

You may use the illustrated vocabulary method. (see reduced size illustration in column to right)

Students will.....

FOLD a piece of paper to make 4 boxes.

LABEL each box as shown in example to right

CHOOSE 2 out of 3 words to illustrate.

COMPLETE the illustrated vocabulary.

ASSESSMENT:

Teacher will....

ADMINISTER a 5 point quiz (found in column to right)

word	drawing
definition	sentence

QUIZ - Dissolved Oxygen

1. Name three things that dissolve in water that you cannot see once they are dissolved. (*Salt, sugar, oxygen*)
2. Oxygen that is mixed in water is called what? (*dissolved oxygen*)
3. Who uses dissolved oxygen? (*Animals in the water called aquatic organisms*)
4. Why is dissolved oxygen useful? (*It helps aquatic life to breathe*)
5. Which is healthier for the aquatic environment, a high amount of dissolved oxygen or a low amount of dissolved oxygen? (*High amount of dissolved oxygen*)

Previsit Lesson 5: WATER TESTING: TEMPERATURE

ACADEMIC VOCABULARY

Celsius, Fahrenheit

LESSON PREPARATION:

Make a copy of the worksheet for each student, prepare overheads, prepare three different temperatures of water in 3 clear water glasses. Use food coloring to distinguish between the different temperatures of water.

PART 1 - HOW TO READ A THERMOMETER & HOW TO MEASURE WATER TEMPERATURE

Temperature can be measured using different scale systems. In the United States, we use the Fahrenheit scale. Most other countries in the world use the Celsius scale. Scientists use the Celsius scale. To know which scale is being used, a label is put at the end of the temperature number. The letter F stands for degrees Fahrenheit and the letter C stands for degrees Celsius.

BUILDING BACKGROUND:

Teacher will.....

ASK "What is a thermometer?"

SHOW the overhead How to Read a Thermometer.

POINT to the scale of numbers on either side of the thermometer.

EXPLAIN to the students that there are many different scales to measure temperature, the two most common being Fahrenheit and Celsius.

DISTRIBUTE the worksheet How to Measure Water Temperature.

DEMONSTRATE taking the temperature by using the overhead

model of the thermometer.

ASK students to volunteer the number of a temperature they think is cold.

COLOR in with red transparency marker up to the temperature suggested. The temperatures suggested will probably be in Fahrenheit and across the bulb will be Celsius. Then have the students volunteer a number of a temperature they think is hot and color that in as before. (Be sure to progress from colder to hotter temperatures and watch the red bulb liquid go up!)

DRAW a line across the top of the red mark extending it outside of the thermometer ***after each suggested temperature.***

LABEL the degrees on the line in Fahrenheit and Celsius.

Students will.....

COLOR in the temperatures suggested beginning with cold temperatures and working up to warmer ones just as the teacher does.

DRAW a line across the top of the red mark extending it outside of the thermometer ***after each suggested temperature.***

LABEL the degrees on the line in Fahrenheit and Celsius.

Teacher will.....

SAY this is the way a thermometer responds to temperature changes. The red liquid inside the bulb goes up for warmer temperatures and down for colder temperatures.

OPTIONAL DIRECT INSTRUCTION:

PERFORMANCE OBJECTIVES

Students will.....

- ✳ Practice measuring temperature
- ✳ Record data from measurements
- ✳ Identify the range of temperatures that are livable and healthy for aquatic life
- ✳ Compare healthy water temperature ranges where animals can survive

MATERIALS:

- ❖ Thermometers
- ❖ Warm water
- ❖ Worksheet How to Measure Water Temperature
- ❖ Overhead transparencies of How to Measure Water Temperature, How to Read a Thermometer, Temperature Ranges for Survival of Aquatic Life
- ❖ Overhead projector w/ red marker
- ❖ Calculators, scissors, red or orange colored pencils, food coloring
- ❖ Ice water, warm water, hot water

Teacher will.....

PRESENT the glass of ice water.
ASK students to guess the temperature of the glass of ice water.
COLOR in red the bulb on the overhead transparency up to suggested degrees.
ASK the students "What is the temperature? How can you tell?"
SHOW where the top of the red stops and how it relates to the number on the Fahrenheit scale.

GUIDED PRACTICE:

Teacher will....

SHOW the overhead transparency How to Measure Water Temperature.
DISTRIBUTE How to Measure Water Temperature.
MEASURE the temperature of the ice water with the real thermometer.
ASK a student to read the temperature out loud.
COLOR in red on the transparency.
DRAW a line across the top of the red mark extending it outside of the thermometer.
LABEL the degrees on the line in Fahrenheit and Celsius.

Students will.....

COLOR in the thermometer bulb up to the number on the Fahrenheit scale on their paper model.
DRAW a line on the top of the red mark.
LABEL the degrees in Celsius and Fahrenheit.

Teacher will.....

MEASURE the temperature of the glass of warm water.

ASK a student to read the temperature out loud.
COLOR in the red on the transparency.
DRAW a line on the top of the red mark.
LABEL the degrees in Celsius and Fahrenheit.

Students will.....

COLOR in the thermometer bulb up to the number on the Fahrenheit scale on their paper model.
DRAW a line on the top of the red mark.
LABEL the degrees in Celsius and Fahrenheit.

Teacher will.....

MEASURE the temperature of the glass of hot water.
ASK a student to read the temperature out loud.
COLOR in the red on the transparency.
DRAW a line on the top of the red mark.
LABEL the degrees in Celsius and Fahrenheit.

Students will.....

COLOR in the thermometer bulb up to the number on the Fahrenheit scale on their paper model.
DRAW a line on the top of the red mark.
LABEL the degrees in Celsius and Fahrenheit.

CLOSURE:

Teacher will....

EXPLAIN when they are at

Patagonia Lake, they will be measuring lake water temperatures at several locations with real thermometers and recording the information.

PART 2 - TEMPERATURE RANGES FOR SURVIVAL OF AQUATIC LIFE

Plant and animal life is dependent on a specific range of temperatures in order to survive. Warm water (greater than 68° F) supports abundant plant life and warm water fish such as crappie, bluegill, bass and catfish. Cold water (less than 55° F) supports trout and the insects they feed on such as caddis fly, mayfly and stonefly. The midrange temperatures (55-68° F) support salmon, water beetles and trout. The amount of dissolved oxygen depends on water temperature. **Cold water holds more oxygen, warm water holds less.**

BUILDING BACKGROUND:

Teacher will.....

EXPLAIN that certain fish and other aquatic creatures tolerate a specific range of temperatures and that if the temperatures go above or below that range, the animal will probably die.

OPTIONAL DIRECT INSTRUCTION:

Teacher will....

SHOW the overhead transparency Temperature Ranges for Survival of Aquatic Life.

COLOR in the ranges of temperatures at 68 degrees F and above.

LABEL the animals that live in those temperatures.

Fish: Crappie, Bluegill, Catfish, Bass

Phytoplankton, Zooplankton, Algae, Aquatic plants

Students will.....

COLOR in the ranges as the teacher does.

Teacher will.....

COLOR in the midranges.

LABEL the animals that live in those temperatures.

Fish: Salmon, Trout

Water Beetles

Students will.....

COLOR in the ranges as the teacher does.

Teacher will....

COLOR in the ranges of temperatures at 55 degrees F and lower.

LABEL the animals that live in those temperatures.

Fish: Trout

Caddis fly, Stonefly, Mayfly

Students will.....

COLOR in the ranges as the teacher does.

ENRICHMENT:

Teacher will.....

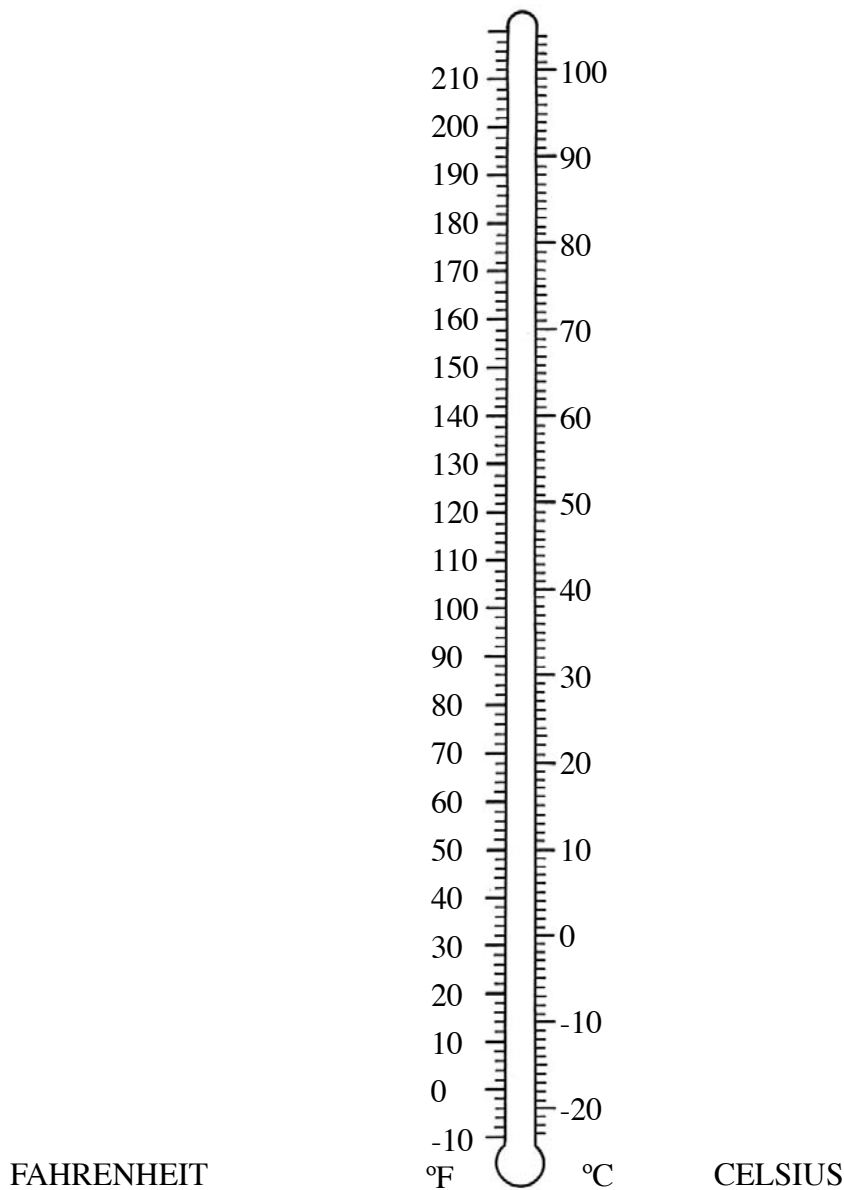
DEMONSTRATE how to convert from Fahrenheit to Celsius.

(Subtract 32° from the Fahrenheit number, multiply by 5 and divide by 9 to obtain Celsius).

Pair students up and let them practice taking temperatures, recording the numbers and converting to Celsius.

HOW TO READ A THERMOMETER

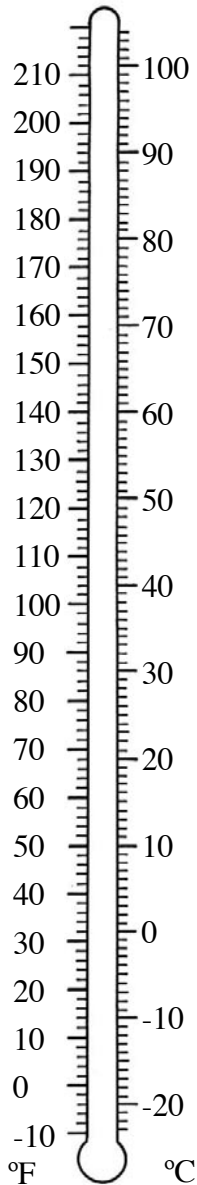
A thermometer is a science tool that measures the temperature of air and liquids. A colored liquid inside the thermometer rises or falls depending on the temperature of the substance being measured. There are many different scales to measure temperature. The two most common are Fahrenheit and Celsius. Look at the top of the colored liquid inside the tube of the thermometer and read the number on the side of the thermometer. This number is the measurement of temperature.



THERMOMETER

HOW TO MEASURE WATER TEMPERATURE

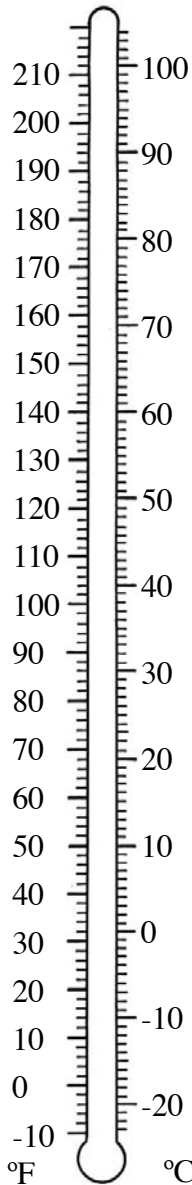
Temperature is a measurement of how hot or cold something is. This measurement is called DEGREES Fahrenheit or DEGREES Celsius. To measure the temperature of water, place a thermometer in the water and watch the red line go up or down. When the red line stops moving, read the number that is in line with the top of the red. Record the number in the blank under the thermometer drawing for F (Fahrenheit) and C (Celsius). Color in red on the drawings below to show what the temperature is.



Cold Water
temperature is:

_____ °F

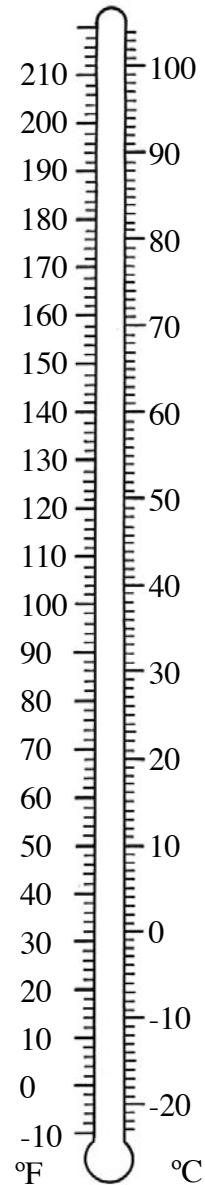
_____ °C



Warm Water
temperature is:

_____ °F

_____ °C



Hot Water
temperature is:

_____ °F

_____ °C

TAKING TEMPERATURES LABORATORY RESULTS

In this activity, you will take temperature readings of several items using the Fahrenheit scale. Then you will convert this temperature to Celsius. When you visit Patagonia Lake, you will be recording all temperatures as Celsius, just like other scientists do!

Outside temperature _____ °F

Temperature inside classroom _____ °F

Sink water temperature _____ °F

What else can you find that you can take the temperature of? Write the name of the item and its temperature in the spaces below:

Item:

temperature:

Now you can convert, or change the Fahrenheit temperature to Celsius by doing a bit of simple math. First, SUBTRACT 32° from your Fahrenheit number. Then MULTIPLY that number by 5. Now, DIVIDE that number by 9.

Outside temperature _____ °F - 32° = _____ X 5 = _____ ÷ 9 = _____ °C

Temperature inside classroom _____ °F - 32° = _____ X 5 = _____ ÷ 9 = _____ °C

Sink water temperature _____ °F - 32° = _____ X 5 = _____ ÷ 9 = _____ °C

Can you do it backwards?

To calculate from Celsius to Fahrenheit, just do the opposite of what you did to convert to Celsius! First, multiply the Celsius by 9, divide by 5, and add 32!

One year the temperature in Phoenix was 50° C.

Is that really hot or really cold? _____

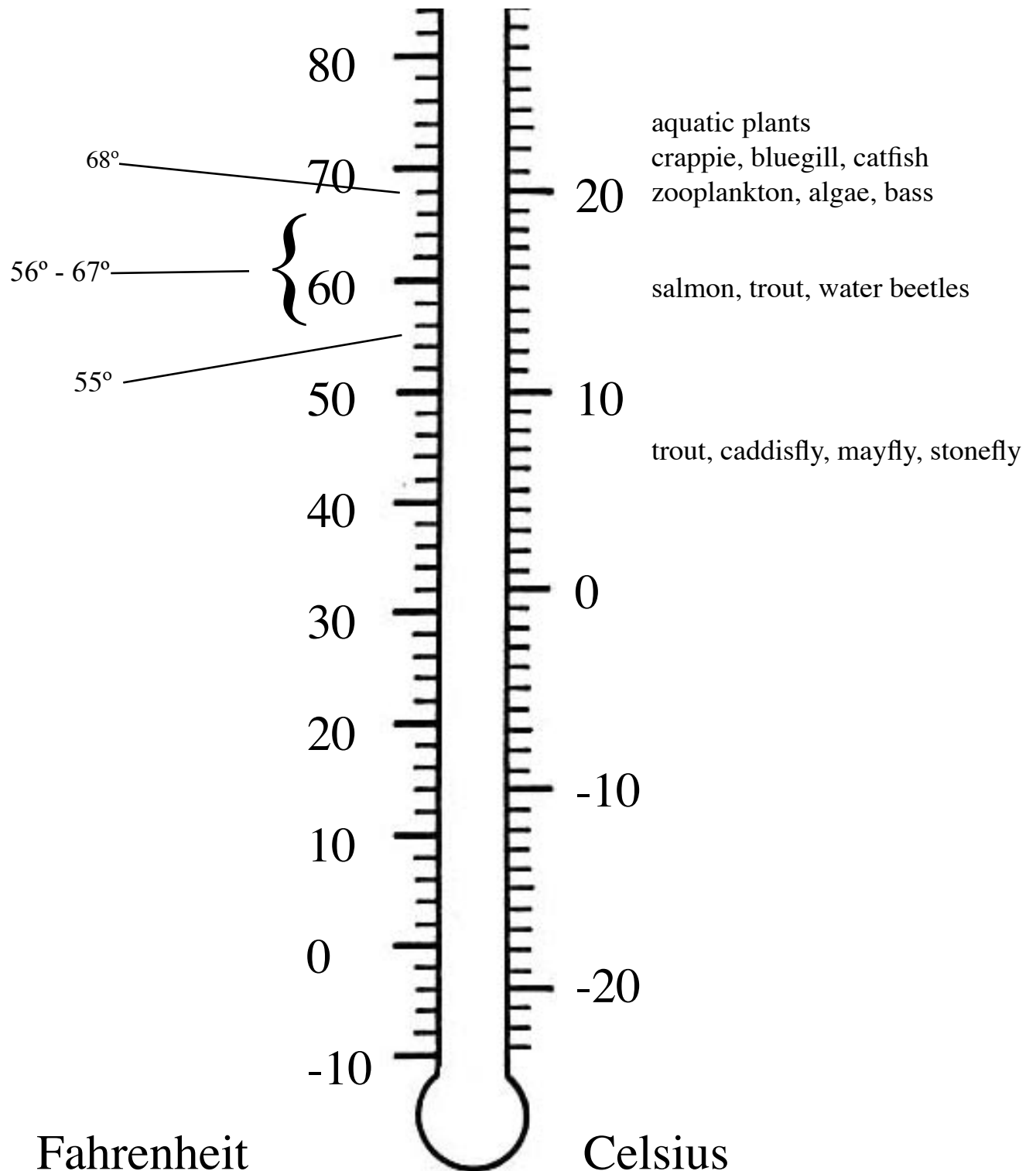
What would that be in Fahrenheit? Let's calculate that:

50°C X 9 = _____ ÷ 5 = _____ + 32° F = _____ WOW!

Your body temperature is about 37°C. What is that in Fahrenheit?

37°C X 9 = _____ ÷ 5 = _____ + 32° = _____ °F

TEMPERATURE RANGES FOR SURVIVAL OF AQUATIC LIFE

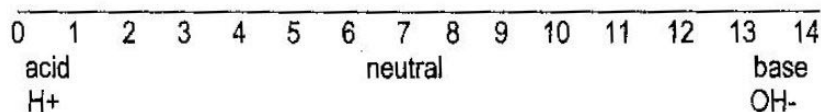


Previsit Lesson 5: A pHantastic pH Test!

BACKGROUND INFORMATION:

pH stands for “potential of Hydrogen” and measures how basic (alkaline) or acidic the water, or any other substance is. The pH scale represents the amount of (OH⁻) hydroxide ions for alkaline solutions and the amount of H⁺ ions for acidic solutions. As with temperature, plants and animals thrive at or near neutral range and have difficulty living if the water is too acid or alkaline. Even slight changes in pH can cause some organisms to die. The tolerable range for most species is 6.0 to about 9.0. The scale for pH spans from 0 (acid) to 14 (basic or alkaline).

pH scale



Each number is an increase by a factor of ten. In other words, 6 would be 10 times more acidic than 7. Typical pH ranges for common liquids are:

Lemon juice 2.4
Vinegar 3.0
Orange juice: 3.5
Rain: 5.6
Saliva: 6.4-6.9
Milk: 6.5
Tap Water: 7.0
Blood: 7.35-7.45
Tears: 7.4
Salt water 7.5
Milk of Magnesia 10.6
Household ammonia: 11.5
Drain cleaner 12.0

LESSON PREPARATION:

Prepare the Red Cabbage Jiffy Juice Test Paper.

Add one small scoop of the Red Cabbage Jiffy Juice powder to about 10 milliliters of water. Cut coffee filter papers in strips, about ½ inch by 2 inches. Use the dropper to put the red cabbage solution on the strip and allow to dry. Note, different papers may have different acidities that can change the color of the red cabbage solution on the paper. To determine the pH of a solution, put a drop of it on the red cabbage test paper.

Assemble items to test: (You do not

need all of these, but ammonia and vinegar are the strongest base and acid, respectively, and will give the most dramatic results. Everything else will fall someplace between them.)

baking soda, lemon juice, vinegar, cream of tartar, antacid tablets, household ammonia, orange juice, milk. Dissolve each dry item in its own small cup or container with a small amount of water.

Copy a pH Lab Results Sheet for each student, or 1 per group if you have them working in groups. If you do this as a demonstration, you can write the results on the whiteboard.

PERFORMANCE OBJECTIVES

Students will.....

- ✧ Understand the term pH
- ✧ Understand the difference between an acid and a base

MATERIALS:

- ❖ Lemon juice
- ❖ Vinegar
- ❖ Milk of Magnesia
- ❖ Orange juice
- ❖ Baking soda
- ❖ Milk
- ❖ Water
- ❖ Red Cabbage Jiffy Juice materials
- ❖ Coffee filters
- ❖ Containers for each item to be tested
- ❖ pH lab worksheet per group or student

ACADEMIC VOCABULARY:

pH
acid
base

TO TEACH:

1. Ask students if they have ever tasted lemon juice or vinegar. What did they think it tasted like? (Sour would be the probable answer.) Explain that it is because it is a weak acid. Can they think of any other acids they have heard of? (Might have one or two who know about battery acid or muratic acid that is used in swimming pools.) Explain that the opposite of acid is alkaline. They probably haven't tasted things that are very alkaline because they are unpleasant tasting or downright dangerous to eat! (Some may be familiar with lye, which is used to dissolve clogs in drainpipes.)

2. Explain that the measure of whether a liquid is alkaline or acid is called pH. pH ranges from 0 (very, very acidic) to 14 (very, very alkaline). Things at or close to 0 or to 14 are very dangerous to humans. What do they think the pH of water is? Does it taste sour? (no) Is it dangerous to drink? (no) It is a neutral pH, about 7, which is very pleasant and agreeable to living creatures such as humans.

3. Explain that they are going to test pH of some common liquids using test strips that will turn color to give us clues as to the pH of the liquid. (Or you can do this as a demonstration.)

4. Hand out pH Lab Results Sheet and explain the color chart at the top, and give instruction on how to fill in the chart.

5. Using a dropper, have the students

place a drop of the liquid on the filter paper strips and compare the resulting color to the scale. They will fill in the lab results sheet using their test observations.

ASSESSMENT:

Students will be able to answer the questions at the bottom of the pH Lab Results page.

pH LAB RESULTS

Scientists keep very detailed notes on their experiments so they can remember what they did and they can look at them again if they have questions. This page is for you to record your results as you do the pH experiment.

Name _____

Date of experiment _____

Compare your test strip to these colors:

pH	2	4	6	8	10	12
Color	red	purple	violet	blue	blue-green	green

Remember: the low numbers are acid and the higher numbers are alkaline. Things in the 6 to 9 range are considered neutral (not acid or alkaline)

What I tested:	What color the paper turned:	What pH number is this closest to?	Is this an acid, neutral, or alkaline?

1. Of the items you tested, which one was the most extremely acid ? _____

2. Of the items you tested, which one was the most extremely alkaline? _____

3. Of the items you tested, which ones were neutral? _____

4. Thinking ahead to your field trip to Patagonia Lake, what do you predict the pH of the lake is going to be?

_____ Why do you think that? _____

When scientists predict what they think will happen, that is called a *hypothesis*. You will be able to test your hypothesis when you test the pH of the lake water!

Postvisit Lesson 1: A FISH'S TALE OF WATER POLLUTION

LESSON PREPARATION:

PREPARE for A Fish Tale by filling a glass jar 3/4 full with tap water and putting the plastic fish on the string into the jar.

PREPARE a glass of hot water.

Have all materials readily available for use during the reading of A Fish Tale.

PART 1: WHAT IS POLLUTION?

Concern is increasing about the quantity and quality of our water supply. For decades, rivers, creeks and washes have been a dumping ground for waste. Sometimes waste is dumped directly into a creek, river, or lake through pipes and other easily traceable means. This is called *point source pollution* because the point or source where the pollution originates can be identified. *Non-point source pollution* is much more difficult to trace and may be caused by runoff from agricultural land, from a subdivision, or other broad sources that cannot be easily pinpointed.

BUILDING BACKGROUND:

Teacher will.....

ASK "What is pollution?"

WRITE the correct answers to the question on the board.

ASK "What are some ways that people pollute the earth?"

WRITE answers to the question on the board.

SHOW students the photographs of a fish kill and the picture of a bird covered with oil after an oil spill.

ASK "What causes these disasters to happen?" Accept all answers.

SAY "In this activity, we will learn about water pollution."

PART 2: A FISH TALE

Water pollution should be a matter of concern to all people. In one way or another, all people are affected by such pollution and must take responsibility for controlling, and hopefully, preventing it. As you read the story about Bob the Bass, pause and add the ingredients into the jar of water with the fish. These represent sources of pollution that affect Bob the Bass and other living things. Then discuss means of preventing, or at least controlling, sources of pollution.

INSTRUCTION:

Teacher will.....

SAY "Now that we understand pollution, let's read a story about a fish named Bob the Bass."

READ A Fish Tale and add the "pollutants" to the jar of water containing the fish as indicated in the story.

READ "Imagine a creek as it meanders through the land, past a rancher's field, flowing into a lake, but then narrowing again into a creek after it passes through a narrow tube at the dam at the end of the lake. In this creek lives a fish named Bob the Bass."

ASK "How does it feel to be Bob?"
Accept all answers

PERFORMANCE OBJECTIVES

Students will.....

- ✧ Be able to identify sources of pollution
- ✧ Be able to suggest ways for preventing or controlling water pollution

MATERIALS:

- ❖ Copy of "A Fish Tale"
- ❖ Photo of fish die-off
- ❖ Photo of bird covered in oil
- ❖ Large glass jar
- ❖ plastic fish suspended from string or wire
- ❖ Handful of soil
- ❖ Pancake syrup
- ❖ Salt
- ❖ Bits of paper
- ❖ Liquid dish soap
- ❖ Cup of hot water
- ❖ Red food coloring
- ❖ Sand
- ❖ Clump of grass or vegetation

ACADEMIC VOCABULARY:

creek
erode
fertilizer
pollution
subdivision

READ Bob swims down creek past an eroding bank. When it rains what will happen to the bank? What if it rains a great deal?

ADD soil into the water

ASK "How does it feel to be Bob?"

READ Suppose part of the soil eroding into the water came from some ranchland. The rancher has just put fertilizer on the land to help the grass grow. Instead of staying on the soil the fertilizer rides "piggyback" on the eroding soil and goes into the creek.

ADD sand to simulate fertilizer.

READ What effect will the fertilizer have on the plants in the creek? If the plants grow too abundantly and too fast the creek can't continually support them and supply the necessary nutrients. They die, fall to the bottom, and start to decompose. Decomposing things use oxygen.

ADD grass or vegetation

ASK "What else in the creek needs oxygen?" (fish, aquatic insects and other tiny creatures)

ASK "How does it feel to be Bob?"

READ Rancher's fields are not the only source of pollution in a creek. Homes may also be a source. Many homes have been built along the creek. Perhaps their septic tanks drain into the water or some of the fertilizers they've put on their lawn have washed into the water.

ADD liquid dish detergent to represent pollution from septic tanks

ASK "How does it feel to be Bob?"

READ As Bob continues to swim down the creek, he goes past a city. Even

though the city people don't pollute the water directly, what they do at their own homes or subdivisions can affect the quality of the creek's water. Have you ever seen a car leaking oil? Where does the rain wash this oil? ADD pancake syrup, representing oil, into the jar.

ASK "How does it feel to be Bob?"

READ Suppose the city has a park next to the creek. People litter in the park and some of it blows into the water.

ADD pieces of paper into the jar.

ASK "How does it feel to be Bob?"

READ As the creek leaves the city, there are several factories located along it. Although rules are strict, perhaps the factory is still dumping some chemicals, detergent, or heated water into the creek.

ADD salt and hot water into the water.

ASK "How does it feel to be Bob?"

READ The wastewater treatment plant for the city is also located along this section of the creek. Sometimes rules aren't quite as strict as they are for factories and perhaps the treatment facilities aren't as thorough as they could be. The plant does its best but still has to put some polluted water into the creek. The creek has a large amount of water though and the plant only puts a small amount of pollution into it. It shouldn't cause too much of a problem, Right? It would be like putting two drops of this food coloring into this jar of water.

ADD two drops of red food coloring
40

into the water and then stir it.
ASK "How does it feel to be Bob?"
Accept all answers.

The End (of a sad fish tale)

CLOSURE:

After reading through the story, hold up each pollutant and

ASK "How can you help prevent this pollutant from being added to the water?" Accept answers from students.

ASK "Where should the dirty water in the jar be dumped? After someone suggests spreading it outside over the ground, agree and

SAY "The grass and especially the soil will act as a natural filter to pollution if the filtering system is not over-loaded. The fish and paper will be discarded in the wastepaper basket. The "oil" used was really pancake syrup. Real oil would be much more difficult to "clean up" by any natural processes.

OR After someone suggests dumping it down the sink agree and

SAY "Dumping this down the sink will cause the pollutants to eventually enter a waste-water treatment plant, where the water will be cleaned up.

ENRICHMENT:

1. Have small groups of students do the same, or similar, demonstrations on their own. Are there pollutants missing from A Fish Tale that should be included? Ask students to rewrite the story adding these pollutants.

2. Have students devise ways of cleaning up the water "polluted" during the demonstration other than

dumping it directly on the ground or sending it to a waste-water treatment plant. Have them use references to find ways in which different communities clean up wastewater.

3. Have students collect information about sources of water pollution in their own community. Have them consider ways to help control or prevent the pollution from occurring. Find out what efforts are being made to control water pollution in your community and what laws are in effect to reduce the amount of pollution.

Adapted from A Fish Story by Pat Chilton-Stringham, for Sonoita Creek State Natural Area.

Postvisit Lesson 2: BULLETIN BOARD ACTIVITY

PART 1: WHAT CAUSES WATER POLLUTION BULLETIN BOARD ACTIVITY

Construction of a bulletin board can focus all of the information and conclusions into a visual summary for students.

LESSON PREPARATION:

Create a large-scale bulletin board with a lake and sky. (example at end of lesson) Choose a title for the bulletin board. Possible titles could be: "What Causes Water Pollution?" or "Causes of Water Pollution"

Cut construction paper into small squares, about 3" X 3." Use light brown, tan, gray, olive green, yellow, any other light and unattractive color for the "pollution blobs" (blob design at end of lesson or have students create their own)

Copy pledge fish onto paper to be cut out later by students (fish design at end of lesson, or students can make their own).

Teacher will...

Have the students trim the 3" X 3" squares to resemble "blobs." (See example).

SAY "Now we're going to brainstorm the various causes of water pollution." WRITE the brainstormed ideas on the board.

Students will...

WRITE an example of water pollution on their "blob."

Sonoita Creek State Natural Area 2008

FASTEN the pollution "blobs" to the appropriate "cause" location; either natural or human.

Students will...

CUT out the pledge fish or make their own fish shape.

WRITE in the blanks: This is how I can reduce water pollution _____ Sign and date.

ATTACH the fish in the water section of the bulletin board.

PART 2: DATA RECORDING AND ANALYSIS

The temperature of water is dependent upon time of year. During summer, the coldest water might be found mid-lake, where water comes from deepest part of lake. The warmest water may be at the stream inflow or shoreline where the water is shallowest and can heat in the sun. During fall and winter, coldest water could be found at inflow (last night's temperatures upstream), mid-lake (lake turnover brings cold water up from bottom) or shoreline (may have frozen overnight). The warmest water could be anywhere. Springtime may find the coldest water at mid-lake (stays cold longest because of volume).

Warmest water may be at inflow (warming land upstream and stronger sunlight increase temps), or near the shoreline where the shallow water heats quicker.

Turbidity can change with various factors. Highest turbidity may be found at the shoreline from such things as: wave action from boats, 43

PERFORMANCE OBJECTIVES

Students will....

- * Identify causes of water pollution
- * Identify if the causes of water pollution are natural or human caused
- * Identify ways students can create less water pollution
- * Graph their results from the water quality testing performed at the park

MATERIALS:

- ❖ Scissors
- ❖ Brown paper
- ❖ Gray paper
- ❖ Olive green paper
- ❖ Yellow paper
- ❖ Blue paper
- ❖ White paper
- ❖ Colored markers
- ❖ Stapler/staples

ACADEMIC VOCABULARY:
dissolved oxygen
pH
pollution
temperature
turbidity

wind driven waves, more swimmers or birds feeding in the water, increased plant growth or runoff from storms. High turbidity may be found at mid-lake or inflow due to increased runoff from storms.

Dissolved Oxygen is dependent upon water temperature as well as other factors. Colder water holds more dissolved oxygen. Agitated water like that found in a tumbling stream or along the shore where waves are breaking has more oxygen as well. Stagnant water or that which has decaying plant and animal matter (detritus) will have less, since oxygen is used during the decay process. Dissolved oxygen will usually be at its lowest level right before dawn. Plant photosynthesis, which is dependent upon sunlight, produces more oxygen in the water. A large number of animals in the water can deplete the O₂, because they use it during respiration.

Create a large-scale bulletin board to graph results from water quality testing at the park.

Draw the four graphs on the bulletin board (examples at end of lesson)
In addition, follow-up questions maybe added to the graph.

Temperature

Highest temperatures from: (location).
Why? ____
Lowest temperatures from: (location).
Why? _____

pH

Most alkaline water from: (location)
Most acidic water from: ____
(location)

Turbidity

Most turbid water from: ____
(location) Why? _____
Least turbid water from: ____
(location) Why? _____

Dissolved Oxygen

Most dissolved oxygen from: (location) Why? _____
Least dissolved oxygen from: (location) Why? _____

Students will...

WRITE their group's data on the four graphs on the bulletin board. Groups should be assigned a bar graph pattern and/or color and a line graph symbol and/or color. (Strips of colored construction paper could be cut to correct lengths and used as the bars-refer to example graphs).

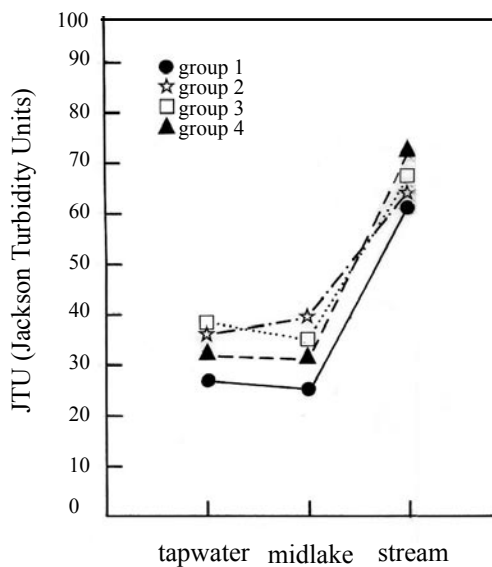
If the follow-up questions are used,
Students will...

WRITE the answers to the questions regarding the highest and lowest recorded temperature location and why.

WRITE the answers to the questions regarding the highest and lowest recorded pH location.

WRITE the answers to the questions regarding the highest and lowest recorded turbidity location and why. WRITE the answers to the questions regarding the highest and lowest recorded dissolved oxygen location and why.

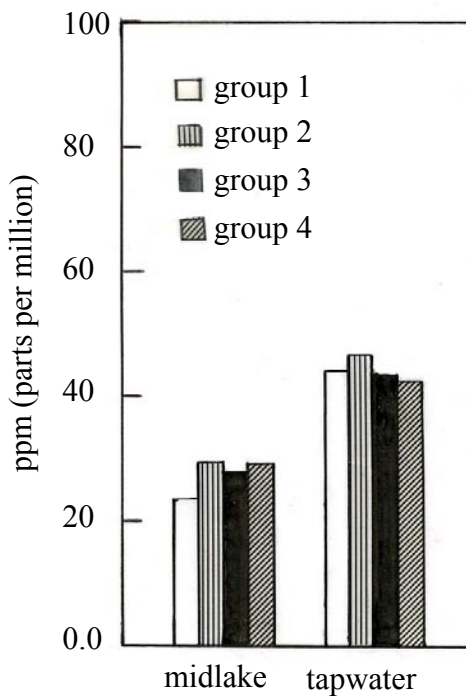
Turbidity



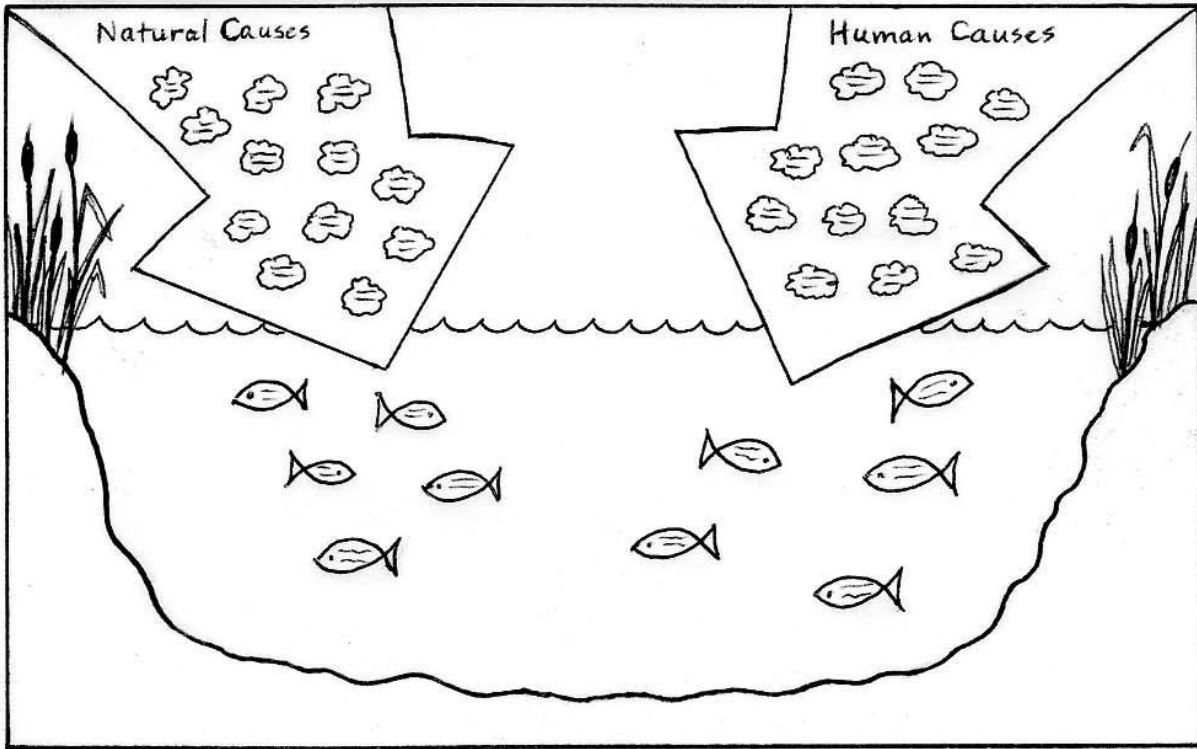
*These graphs are examples of the many types your students can create with the data.

Sample graph types:

Dissolved oxygen



What Causes Water Pollution?



This is how I can create less water pollution: _____

Signed: _____

Use this graphic for natural and human causes of pollution

This is how I can create less water pollution: _____

Signed: _____

Healthy Water Evaluation Form

Sonoita Creek State Natural Area is committed to providing a high-quality education program for students in Santa Cruz County. Please help us improve the Healthy Water Education Program by taking a few moments to fill out this evaluation. An addressed and stamped envelope is provided for your convenience.

1. Please circle the grade level of your students.
Second Third Fourth Fifth Sixth Other _____
2. Was the Pre-Trip Information helpful in preparing you for the program (including the pre and post lessons and the field trip)? *(please circle one)* Yes No
If no, please explain: _____

3. Which of the previsit lessons did you complete with your students?
vocabulary microscope water cycle dissolved oxygen temperature pH none
4. Do you feel that the pre-lessons prepared your students appropriately for the Field Trip component of the program? *(please circle one)* Yes No
If no, please explain: _____

5. Was the format of the pre and post lessons in the Healthy Water Teacher's Guide easy to follow and understand? *(please circle one)* Yes No
If no, please explain: _____

6. Did you use the items provided in the box to help you work through the pre-lessons?
(please circle one) Yes No
7. If you choose to participate in this program in the future, would you like us to provide the items in the box again? *(please circle one)* Yes No
Are there any other items you would like us to provide? _____
8. Which post-visit lessons in the Healthy Water Teacher's Guide did you complete with your students?
A Fish Story Bulletin Board none
9. Do you feel that the post-lessons helped tie together the various topics and components of the Healthy Water Program for your students? *(please circle one)* Yes No
If no, please explain: _____

10. The purpose of the Healthy Water Program is to foster an appreciation and understanding of water and the importance of protecting and keeping water clean and safe for people, plants and animals to use. Do you feel that this program accomplished this?
(please circle one) Yes No
If no, please explain: _____

11. Please provide any other comments you may have to help us improve the Healthy Water Program. _____

Arizona Department of Education

Curriculum Standards

GRADE 3 STANDARDS

This teachers guide aligns with the following state standards for third grade students in Arizona.

3rd Grade Science Standards

Activity	Strand 1 Inquiry Process	Strand 2 History and Nature of Science	Strand 3 Science in Personal and Social Perspectives	Strand 4 Life Science
Lesson 1-Microscope			C2, PO 1	
Lesson 2-Water Cycle		C2, PO 1,2		
Lesson 3-DO			C2, PO 1	C3, PO 1 C4, PO 1,2,3
Lesson 4-Temperature			C2, PO 1	C3, PO 5
Lesson 5-pH Lab				
Lesson 6-A Fish Story			C1, PO 1,2	C4, PO 1,2,3
Lesson 7-Bulletin Board	C4, PO 1, (2), 3		C1, PO 1,2	
Vocabulary Pictionary				
Field Trip to the Park	C1, PO 1,2 C2, PO 1,2,3,4,5 C3, PO 1,2,3,4,5	C1, PO 2	C2, PO 1	C3, PO 1,2,5

Extensions

S 1, C 4, PO (2)-Have students write a paper with directions on how to test water so that others can repeat the process.

3rd Grade Writing Standards

Activity	Strand 3 Writing Applications
Lesson 1-Microscope	
Lesson 2-Water Cycle	C(1), PO (1,2)
Lesson 3-DO	
Lesson 4-Temperature	
Lesson 5-pH Lab	
Lesson 6-A Fish Story	
Lesson 7-Bulletin Board	
Vocabulary Pictionary	
Field Trip to Park	C(3), PO (2) C(6), PO (1,2,3)

Extensions:

Strand 3, C (1), PO (1,2)-Have students write a story about the water cycle, write a dichotomous key story.

Strand 3, C (3), PO (2)-Have students write thank-you notes to the park staff and volunteers.

Strand 3, C (6), PO (1,2,3)-Have students research and write a report about the aquatic insects found at the park.

3rd Grade Reading Standards

Activity	Strand 1 Reading Process	Strand 3 Comprehending Informational Text
Lesson 1-Microscope		
Lesson 2-Water Cycle	C3, PO 1	
Lesson 3-DO		
Lesson 4-Temperature	C3, PO 4 C4, PO 3	
Lesson 5-pH Lab		
Lesson 6-A Fish Story	C6, PO 2,3,4,6	C1, PO (4)
Lesson 7-Bulletin Board	C6, PO 1,2,3,4,5,6	C1, PO 5
Vocabulary Pictionary	C4, PO (1,2), (4,5,6,7)	
Field Trip to Park	C3, PO 1, 4	C2, PO 1, 4

Extensions:

Strand 1, C4, PO (1-2), (4-7)-Use various vocabulary exercises using the vocabulary words provided to meet these standards.

Strand 3, C 1, PO (4)-Have students research how their community is trying to reduce or prevent pollution or how the students can prevent pollution

3rd Grade Mathematics Standards

Activity	Strand 1 Number and Sense Operations	Strand 2 Data Analysis, Probability and Discrete Mathematics	Strand 3 Patterns, Algebra, Functions
Lesson 1-Microscope	C1, PO 1 C2, PO 13,14,15		
Lesson 2-Water Cycle			
Lesson 3-DO			
Lesson 4-Temperature	C1, PO 1	C(2), PO (1,2)	C(4), PO (1,2)
Lesson 5-pH	C1, PO 1		
Lesson 6-A Fish Story			
Lesson 7-Bulletin Board		C1, PO 1,2,3,4,5,6	
Vocabulary Pictionary			
Field Trip to the Park	C1, PO 1	C4, PO 1,2,4,5,6	

Extensions

Strand 3, C 4, PO 1,2-Leave ice water out and test for temperature later in the day or the next day. Ask students to predict what the water temperature will do as the ice melts.

GRADE 4 STANDARDS

This teachers guide aligns with the following state standards for fourth grade students in Arizona.

4th Grade Science Standards

Activity	Strand 1 Inquiry Process	Strand 2 History and Nature of Science	Strand 3 Science in Personal and Social Perspectives	Strand 4 Life Science
Lesson 1-Microscope	C1, PO 2,3 C2, PO 1,2,3,4,5			
Lesson 2-Water Cycle	C1, PO 1,2,3 C2, PO 1,2,3,4,5			
Lesson 3-DO	C1, PO 1,2,3 C2, PO 1,2,3,4,5			
Lesson 4-Temperature	C2, PO 1,3,4,5			
Lesson 5-pH Lab	C3, PO 1,2,3,4,5 C4, PO 1,2			
Lesson 6-A Fish Story			C1, PO 1,2 C2, PO 3	C3, PO 1,3,4
Lesson 7-Bulletin Board	C1, PO 1,2,3,4 C2, PO 1,2,3,4,5 C3, PO 1,2,3,4,5			
Vocabulary Pictionary				
Field Trip to the Park		C1, PO2 C2, PO 1,2,3	C1, PO 1,2	C3, PO 1,3,4

4th Grade Writing Standards

Activity	Strand 3 Writing Applications
Lesson 1-Microscope	
Lesson 2-Water Cycle	C (1), PO (1,2)
Lesson 3-DO	
Lesson 4-Temperature	
Lesson 5-pH Lab	
Lesson 6-A Fish Story	
Lesson 7-Bulletin Board	
Vocabulary Pictionary	
Field Trip to the Park	C (3), PO (1) C (3), PO (2) C (6), PO (1,2,3)

Extensions

Strand 3, C (3), PO (1)-Have students write a paper with directions on how to test water so that others can repeat the process

Strand 3, C (1), PO (1,2)-Have students write a story about the water cycle, write a dichotomous key story.

Strand 3, C (3), PO (2)-Have students write thank-you notes to the park staff and volunteers.

Strand 3, C (6), PO (1,2,3)-Have students research and write a report about the aquatic insects found at the park.

4th Grade Reading Standards

Activity	Strand 1 Reading Process	Strand 3 Comprehending Informational Text
Lesson 1-Microscope	C 6, PO 1	
Lesson 2-Water Cycle	C4, PO 2	
Lesson 3-DO		
Lesson 4-Temperature		
Lesson 5-pH Lab		
Lesson 6-A Fish Story	C4, PO 2 C 6, PO 3	C 1, PO 8
Lesson 7-Bulletin Board	C 6, PO 4	C 1, PO 6, 8
Vocabulary Pictionary		
Field Trip to the Park	C 6, PO 3	C 2, PO 1,2

4th Grade Mathematics Standards

Activity	Strand 1 Number and Sense Operations	Strand 2 Data Analysis, Probability and Discrete Mathematics	Strand 3 Patterns, Algebra, Functions	Strand 4 Geometry and Measurement
Lesson 1-Microscope	C 2, PO 1,2,4,5,11			
Lesson 2-Water Cycle				
Lesson 3-DO				C4, PO 1,3,4
Lesson 4-Temperature	C 2, PO 1,2,4,5,11		C (4), PO (1,2)	C4, PO 1,3,4,5
Lesson 5-pH				C4, PO 1,2,3,4,5
Lesson 6-A Fish Story				
Lesson 7-Bulletin Board		C 1, PO 1,2,3,4,5,6,7		
Vocabulary Pictionary				
Field Trip to the Park	C 2, PO 1,2,4,5,11			C4, PO 1,2,3,4,5

Extensions

Strand 3, C (4), PO (1,2)-Leave a cup of ice water and a cup of hot water out and test for temperatures later in the day or the next day. Ask students to predict what the water temperature in each cup will do.

GRADE 5 STANDARDS

This teachers guide aligns with the following state standards for fifth grade students in Arizona.

5th Grade Science Standards

Activity	Strand 1 Inquiry Process	Strand 3 Science in Personal and Social Perspectives
Lesson 1-Microscope		C2, PO 1,2
Lesson 2-Water Cycle		C1, PO 1, 2
Lesson 3-DO	C2, PO 1, 4, 5	
Lesson 4-Temperature	C2, PO 2	
Lesson 5-pH Lab	C1, PO 2 C2, PO 1, 2, 4, 5	
Lesson 6-A Fish Story	C1, PO (3)	C1, PO 1, 2, 3 C2, PO 1, 2
Lesson 7-Bulletin Board	C3, PO 1, 2, 3, 5 C4, PO 1, 2, 3	
Vocabulary Pictionary		
Field Trip to the Park	C1, PO 1, 2 C2, PO 1, 2, 3, 4, 5 C3, PO 4 C4, PO 1, 2, 3	C2, PO 1, 2, 3

Extensions

Strand 1, C1, PO (3)- Have students research and write a report about the aquatic insects found at the park, or research pollutants that can be found in the community and what can be done to eliminate or reduce these.

5th Grade Writing Standards

Activity	Strand 3 Writing Applications
Lesson 1-Microscope	
Lesson 2-Water Cycle	
Lesson 3-DO	
Lesson 4-Temperature	
Lesson 5-pH Lab	
Lesson 6-A Fish Story	
Lesson 7-Bulletin Board	
Vocabulary Pictionary	
Field Trip to the Park	C(3), PO 1, 2, 3 C(6), PO 1, 2, 3

Extensions

Strand 3, C (3), PO (1)-Have students write a paper with directions on how to test water so that others can repeat the process

Strand 3, C (3), PO (2-3)-Have students address envelopes and write thank-you notes to the park staff and volunteers.

Strand 3, C (6), PO (1,2,3)-Have students research and write a report about the aquatic insects found at the park.

5th Grade Reading Standards

Activity	Strand 1 Reading Process	Strand 3 Comprehending Informational Text
Lesson 1-Microscope		
Lesson 2-Water Cycle		
Lesson 3-DO		C2, PO 1,2
Lesson 4-Temperature		C2, PO 1, 2
Lesson 5-pH Lab		C2, PO 1,2
Lesson 6-A Fish Story		
Lesson 7-Bulletin Board		
Vocabulary Pictionary	C 4, PO (1,2), (4,5,6)	
Field Trip to the Park		C2, PO 1,2

Extensions

Strand 1, C4, PO (1-2), (5-6)-Use various vocabulary exercises using the vocabulary words provided to meet these standards.

5th Grade Mathematics Standards

Activity	Strand 1 Number and Sense Operations	Strand 2 Data Analysis, Probability and Discrete Mathematics	Strand 4 Geometry and Measurement
Lesson 1-Microscope	C2, PO 3,4		
Lesson 2-Water Cycle			
Lesson 3-DO			C4, PO 1, 3
Lesson 4-Temperature	C2, PO 3,4		C4, PO 1, (2), 4
Lesson 5-pH			
Lesson 6-A Fish Story			
Lesson 7-Bulletin Board		C1, PO 2,3,4,(5), 6, 7, 8	
Vocabulary Pictionary			
Field Trip to the Park	C2, PO 3,4	C1, PO 1	C4, PO 1

Extensions

Strand 2, C1, PO (5)-Have students determine the mean and mode of the data collected at the park.

Strand 3, C (4), PO (1,2)-Leave a cup of ice water and a cup of hot water out and test for temperatures later in the day or the next day. Ask students to predict what the water temperatures in each cup will do.

GRADE 6 STANDARDS

This teachers guide aligns with the following state standards for sixth grade students in Arizona.

6th Grade Science Standards

Activity	Strand 1 Inquiry Process	Strand 4 Life Science
Lesson 1-Microscope		
Lesson 2-Water Cycle	C2, PO1	
Lesson 3-DO		
Lesson 4-Temperature		
Lesson 5-pH Lab		
Lesson 6-A Fish Story		C1, PO1 C3, PO2
Lesson 7-Bulletin Board	C3, PO1,4 C4, PO2	C3, PO2
Vocabulary Pictionary		
Field Trip to the Park	C2, PO 1,3,4,5	

6th Grade Reading Standards

Activity	Strand 1 Reading Process	Strand 3 Comprehending Informational Text
Lesson 1-Microscope		C2, PO1
Lesson 2-Water Cycle		
Lesson 3-DO		
Lesson 4-Temperature		C2, PO1
Lesson 5-pH Lab		C2, PO1
Lesson 6-A Fish Story		
Lesson 7-Bulletin Board Activity		
Vocabulary Pictionary	C4, PO2	
Field Trip to the Park		C2, PO1

6th Grade Mathematics Standards

Activity	Strand 1 Number and Sense Operations	Strand 2 Data Analysis, Probability and Discrete Mathematics	Strand 4 Geometry and Measurement
Lesson 1-Microscope			C3
Lesson 2-Water Cycle			
Lesson 3-DO	C2, PO5		
Lesson 4-Temperature	C2, PO5		
Lesson 5-pH Lab	C2, PO5		
Lesson 6-A Fish Story			
Lesson 7-Bulletin Board		C1, PO 2,3,4	
Vocabulary Pictionary			
Field Trip to the Park	C2, PO5		